EXPERIMENTAL PROSPERITY GAME

for the
ELECTRONICS SUBCOMMITTEE
and the
ELECTRONICS PARTNERSHIP

focusing on options of the

NATIONAL ELECTRONICS MANUFACTURING INITIATIVE

September 7-9, 1994

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Game Objectives

This is the sixth Prosperity Game that has been conducted. The objectives of all these games have been to:

- Stimulate thinking;
- Develop relationships and partnerships among industry, government, labs and universities;
- Explore long-term strategies and policies;
- Lay the foundation for industrial roadmaps; and
- Provide informed input for possible future legislation.

This game is being held in conjunction with the roadmap making effort of the National Electronics Manufacturing Initiative (NEMI) of the Electronics Subcommittee of the Civilian Industrial Technology Committee under the aegis of the National Science and Technology Council. It's three main objectives are:

- Connect the technical and non-technical (i.e., policy) issues that have been developed in the NEMI roadmap-making endeavor;
- Provide energy, enthusiasm and people to help the roadmap succeed;
- Provide insight into high-leverage public and private investments.

Teams

The nine primary teams, Figure 1, are composed of executive management committees of each company and the cabinets of each government. Intra-company issues have been delegated to your subordinates so your work guides the company or government as a whole. The actions of each team are subject to the discipline of a working consensus; i.e., every member of the team can live with the corporate consensus position and no member of the team can do anything that is unacceptable to any other member of the team. Therefore, it is not necessary to choose manager-subordinate roles within teams.

Technology and Policy Toolkit

The Electronics Subcommittee (ESC) is working on a roadmap for the electronics industry through the National Electronics Manufacturing Initiative (NEMI). The roadmap has both technology and non-technology (policy) elements. The Toolkit employed in this game reflects the options examined by the NEMI Roadmap Framework Committee. The Toolkit presents an opportunity to examine those options in the context of simulated but real-world industrial and government policies and actions.

Implementation of a toolkit option changes the constraints of the game. Each option costs money (dollars). The transaction is probabilistic in nature. The more credits you apply to an option, the more likely it will occur. Figure 2 shows a normal cumulative probability distribution with mean of $100M and standard deviation of $50M. As an

Figure 1. Teams worked an independent reality

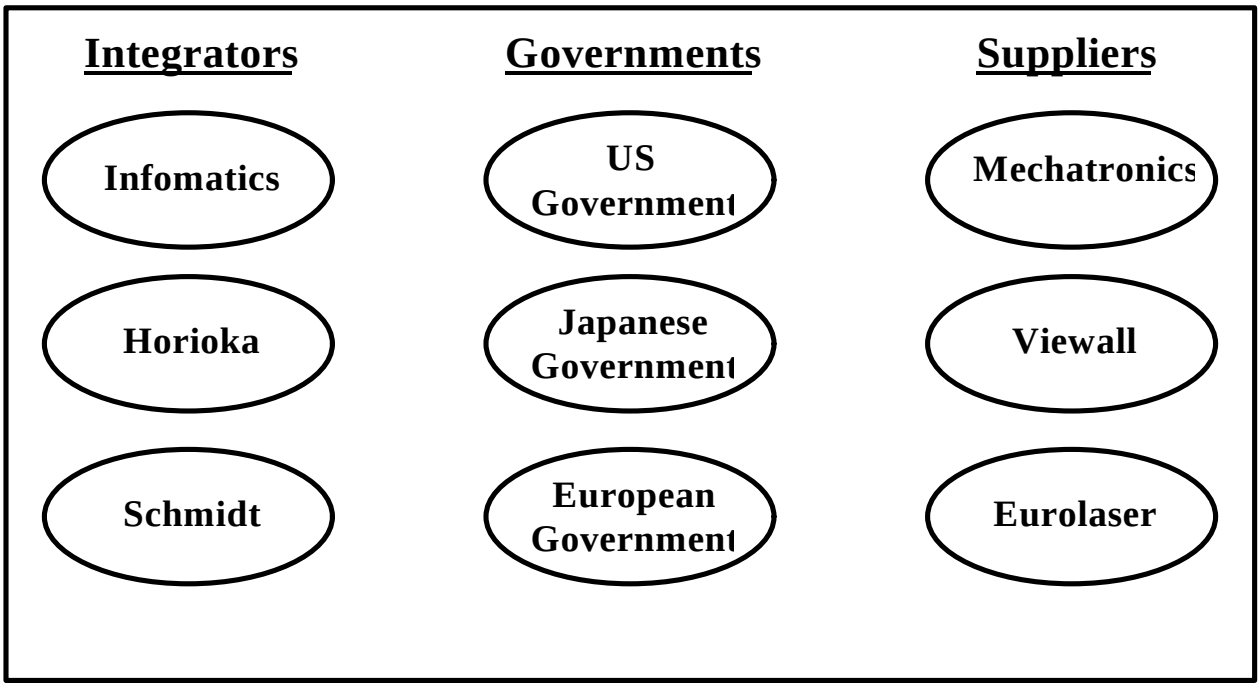
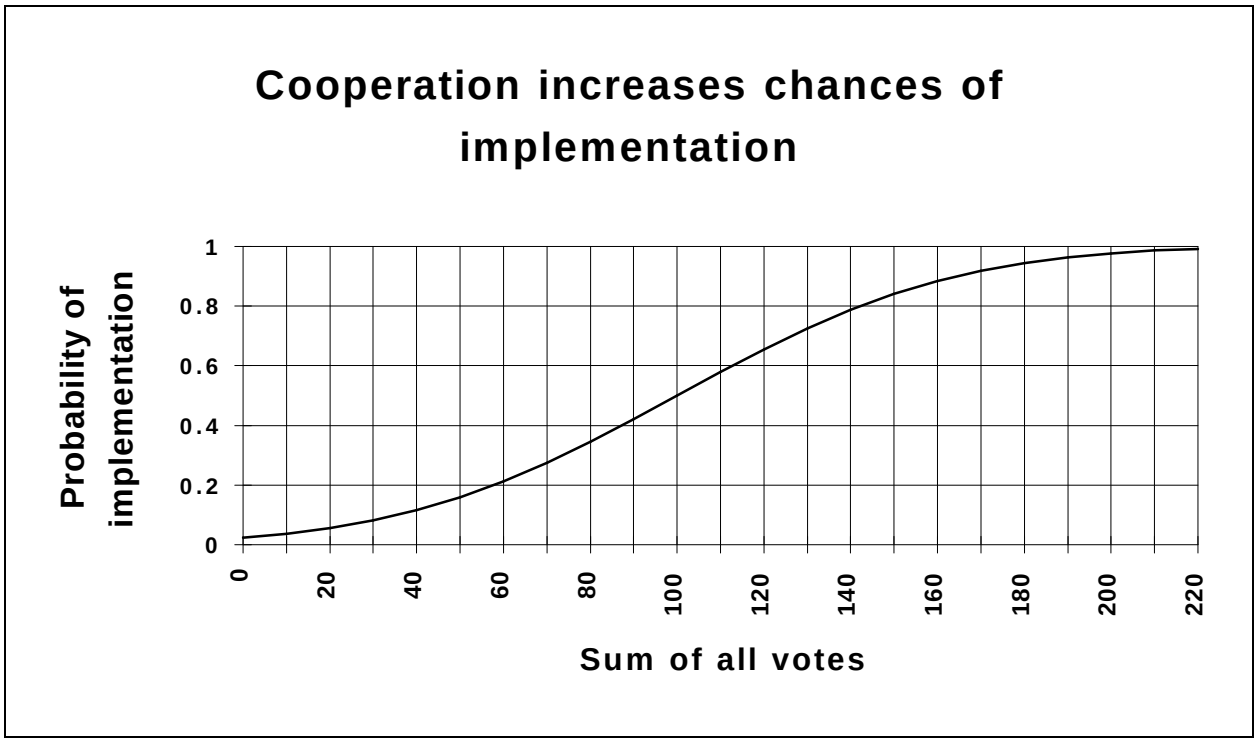


Figure 2. Toolkit options let the teams influence the game in accord with their strategies



example, an investment of $150M would yield a success probability of 0.84; an investment of $200M, twice the mean, would result in a probability of almost 0.98.

In the detailed descriptions of your teams, you have been assigned total initial resources (dollars) that are proportional to your total current assets. Governments have been arbitrarily assigned an initial balance of $500M. These funds can be invested in business deals, R&D investments with other companies or national labs, purchasing patents and rights, etc. However, for investments in Toolkit Options only, the initial capital of the three small companies and the three governments have been increased by an *influence* factor (see Appendix A). This factor simulates the relatively larger influence that governments and smaller companies can exert on policy changes than would be expected only from the assets assigned to those teams. Additional money can be raised by borrowing from the Green Finance Team. The full list of Toolkit options and the investments required for a 50% probability of success are given in Appendix A.

SAMSON - Product Description

The game scenario focuses on an imaginary electronics product called SAMSON, a high-tech personal communicator/entertainment/computer device. Although a current version of SAMSON exists, the final lightweight, portable advanced product will require hundreds of millions of dollars to commercialize. The current product is being developed and manufactured or imported by three companies, one US, one European, and one Japanese. The SAMSON product also has military applications and is viewed by the US Administration as being strategically important. The product is in the middle stage of development, but several key technologies need major innovation for the advanced technology to be successfully commercialized.

SAMSON is a high-tech personal communicator device that is a spin-off of a military global battlefield communication device. The military product is currently very expensive and has limited capability. The ultimate consumer product is envisioned to have full color 3-D displays, bio-sensor interfaces, voice and pattern recognition, global communications, global positioning/location, video and audio links, remote banking, etc. The current product is limited by weight and power consumption, has a B&W 3-D display, and no bio-interfaces. Additionally, a large investment in artificial intelligence (AI) software will be required (approximately $100M is estimated). The key technical challenges are in software, human interfaces (tactile feedback, displays/sensory inputs), color displays, and low-power peripherals and mass storage devices.

The US Administration is about to submit its budget request for the next fiscal year and is willing to consider financial support to SAMSON-type projects, but is uncertain what the best financial levers are; it has requested corporate input and a 5-year technology development/commercialization plan. The US Administration must work within severe budget constraints as well as new treaties such as GATT and NAFTA. Additionally a US - Japan - EC economic/trade summit is imminent. The other Governments require similar information and have similar constraints.

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Schedule for September 7, 1994

6:00 pm	Registration and cocktails; collect materials; get acquainted
6:45 pm	Barbecue dinner with your team members -- A good time to begin discussing team strategies.
7:30 pm	Welcome - Graham Mitchell, Assistant Secretary for Technology Policy, Department of Commerce, and Dr. Lance Glasser, Electronics Subcommittee, ARPA
7:50 pm	Inbriefing with questions from the audience - Dr. Pace VanDevender, Game Director
8:30 pm	Adjourn and read (or reread) the Players' Handbooks and Technology and Policy Toolkit for next day. Begin considering team roles.

Schedule for September 8, 1994

7:30 am Coffee, tea, and calories

8:00 am Management Committees/Government Cabinets meet to accomplish the following: Discuss the team's nature, financial and technical condition, assets, liabilities, goals. Develop a common understanding of the team itself, and the nature of other teams that affect your team's future. Agree on a decision-making process (consensus, voting, etc.). Develop ground rules for conducting business. Assign specific roles as desired; e.g., negotiating emissary, stationary individuals to receive traveling negotiators, US Senator, State Governor, Japanese trade ambassador, European EC representative, etc. Develop a set of strategic objectives consistent with your business and the culture of your country.

8:40 am Review Issues and Options Facing the Company/ Government as described in the Players' Handbook. Develop a set of priorities.

9:05 am Discuss the Technology and Policy Toolkit Options that you wish to advance with your initial budget allocations. Discuss summit agenda for industry-led, government-partnered action.

9:30 am All teams decide on which issues to pursue with their own country's businesses, which to pursue through legislation or regulation changes, and which need to be discussed with other countries (e.g., trade, government R&D investments in industry, business partnering, etc.). Industry teams provide no more than three issues to their Government teams to be discussed at an international economic summit.[1]

Teams decide on negotiation priorities and assignments to further their strategic objectives and, where desired, to team together on allocation of credits for Toolkit Options.

10:00 am **Each team provides strategy to Green Team along with a list of planned contacts to other teams. Government teams also provide their prioritized issues for an economic summit.**

10:15 am Break: Make appointments for later negotiations

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[1]Government teams may propose new legislation within their own countries. These will be evaluated together with the policy options provided in the Toolkit. The passage or rejection of the new (i.e., not in the Toolkit) legislation will be based on a 50% probability if half of the government's credits are allocated to it.

10:30 am Business, Government and Finance teams begin negotiations with emissaries of other teams to identify critical issues, discuss possible agreements, and to pool credits on mutually desired Toolkit Options.

11:00 am **Final team allocations of Toolkit investments are turned in to Green Team.**

Open negotiation period between and among all teams, including Finance, to work issues and opportunities.
* Each team selects a spokesperson for short briefings today and tomorrow to the VIP Panel at the end of the game. **Names are provided to the Green Team** .*

12:00 Working lunch. {Green Team: Toolkit Options are tabulated, probabilities calculated, successes and failures determined, and the results of the voting are determined.}

1:00 pm Three government teams hold an economic summit to discuss their recommended international issues (as determined by the Green Team from the options provided). Industry teams observe.

2:00 pm Green Team announces the results of the Toolkit voting, and the changes in the scenario that have resulted.

2:15 pm Teams reassemble to discuss their progress and any impacts of the altered scenario, both opportunities and threats.

2:45 pm Open negotiations between and among all teams and finance. Deals are made. Handwritten agreements must now be prepared with date, time, and the signatures of a designated team member from each party; agreements are reported to the Green Team for tabulating of financial commitments. Public posting of each deal is preferred, but optional.

4:00 pm **All written agreements are submitted to the Green Team.**

4:15 pm Teams present summaries of deals in plenary session (3-5 minutes each).

5:00 pm Green Team updates scenario with one technology and one policy issue. Analysts provide their written comments to Green Team.

5:15 pm Meeting adjourned. {5:15 - 6:15 pm: Green Team, analysts and facilitators meet and prepare a presentation based on the day's negotiations and analysts' reports.}

6:00 - 9:00 pm: Dinner; additional negotiations are allowed. Analysis of the day's events are reported by the analysts.

Schedule for September 9, 1994

8:00 am Control Team discusses revised scenario (with new technology and policy events); provides revised estimate of SAMSON market (based on probabilistic estimates) and any other relevant information.

9:00 am Teams meet separately to discuss impact of revised scenarios. New plans are developed. New agreements or revisions of previous agreements are discussed. Plans are made for a new round of negotiations between and among all teams. Toolkit options are reconsidered in the light of the revised scenario. Teams may consider an optional second summit, if desired, to discuss issues identified by industry.

10:30 am Break: **New Toolkit investments and summit requests are submitted to the Green Team.**

10:45 am Negotiations on revised scenarios are conducted to advance team strategies.

10:45 am Optional summit in parallel with final negotiation period.

11:45 am All negotiations are completed. **Written copies of final agreements and contracts are submitted to the Green Team.**

11:45 am Lunch for players. Teams prepare brief written summaries of strategies, negotiations, and expected outcomes (two outline pages).
Working lunch for Green Team and analysts. A final briefing is prepared on the projected outcomes of the business decisions, policies, agreements and legislation. They provide their estimates of the status of the businesses and countries over the next five years.

1:00 pm Game Director briefs VIP Panel on the entire game, major agreements and policy suggestions, and projected outcomes.

1:20 pm Each spokesperson, elected from each team, briefs VIP Panel on insights gained (5-7 minutes each).

2:45 pm VIP Panel comments on priorities.

3:00 pm Meeting adjourned. Record feedback with Innovator. Thank all participants.

BRIEF DESCRIPTIONS OF ALL TEAMS

Infomatics Inc. US end-product manufacturer of electronics and computers for the information age

Infomatics is a leader in sales of high-tech personal computers, entertainment and communication devices. It is pioneering, in the US, a new class of devices utilizing virtual reality concepts, global positioning and world connectivity (generically called SAMSON). Infomatics had $3B in sales last year with profits of $200M and invests $300M annually in R&D. It has a US Government contract totaling $3M, annually, to develop advanced displays and other bio-interfaces and has opened discussions with Eurolaser about supplying Infomatics with some critical components.

Infomatics assembles 30% of its products on-shore. Four years ago it was forced to heavily automate assembly and has invested $75M in robotics for assembly. This equipment is in need of a major up-grade. Some of the best automation equipment for assembly is manufactured by its direct competitor, (Horioka, Ltd., a Japanese company with 40% market share of early SAMSON devices, in comparison to your 45% market share). A key component, namely 3-D displays, are manufactured exclusively by View-all, Inc., another Japanese Company. Infomatics owns key patents and intellectual property in software and architecture. These key patents have been licensed to Horioka to obtain these high-tech robotics. These license agreements with the Japanese competitor, Horioka, are due to expire in 18 months.

The Infomatics research department has been working on advanced 3-D displays with an annual budget of $15M. Infomatics has some good technology, but cannot keep up with the $100M R&D in displays being spent by its competitors. Infomatics has submitted several white papers for government funding of its display technology and may shut down the operation if no federal funding is obtained.

Horioka, Ltd. Japanese end-product manufacturer for electronics, computers, and electronics manufacturing equipment

Horioka Ltd. is a major supplier of these high-tech, SAMSON entertainment/communication devices with 40% market share. Its factories are highly automated, utilizing equipment developed internally. Horioka is a large diversified $10B company. Last year, sales of SAMSON products totaled $40M and company executives expect new SAMSON sales to exceed $500M within 3 years of their introduction. Horioka invests $400M annually in electronics R&D. It has license agreements with Infomatics for elements of SAMSON which cover only the first generation, and is developing new technologies to circumvent the patent issues. However, the Infomatics-proprietary operating system leaves Horioka with little

choice but to negotiate a new license agreement, or try to introduce a new operating system which may not have wide acceptance.

Horioka has obtained the patent rights in the past, due to its strong position in automated assembly. Horioka's high levels of automation allow it to manufacture products at a lower cost with higher profit margin than Infomatics. This automated assembly equipment is manufactured and sold worldwide by Horioka's Advanced Automation Division, which supplies automation equipment for the semiconductor and electronics industries with annual sales of about $700M.

Horioka is also a manufacturer of CPU's and DRAM's. Horioka and Schmidt have jointly developed an ultra-low power CPU for SAMSON, which could give Horioka a significant sales advantage.

Horioka purchases 3-D displays from the same Japanese company as Infomatics.

Schmidt, GmbH. **European supplier and end-product manufacturer of electronics**

Schmidt is a European supplier/manufacturer of consumer products such as computers, stereo equipment, and automotive and medical electronics. It has jointly developed, with Horioka, an ultra-low-power CPU which could create a significant sales advantage when used in a SAMSON-like device. Schmidt is seeking a cooperative agreement with either Infomatics or Horioka on the development and manufacture of the SAMSON product. Schmidt has sales of about $3B annually; however, its PC factory in Hamburg is operating in the red and there is pressure to show a profit or close it down. Schmidt's leadership in consumer electronics sales in Europe has you strategically positioned to introduce SAMSON in Europe.

Schmidt has a $1.5M ESPRIT contract (cost shared) to develop advanced bio-sensors which could add additional capability to the SAMSON device for medical applications, sports applications, and for the disabled.

Mechatronics, Inc **US manufacturer of automated manufacturing equipment**

Mechatronics' business is automated assembly of printed circuit boards, and automated wafer handling. It also supplies some robotics to the automotive industry. Additionally, it has developed some automated advanced packaging equipment, but has seen few sales. Mechatronics has total annual sales of $75M, but its sales position has been slipping dramatically. Mechatronics' management hopes these new advanced packaging and robotic assembly tools will help Mechatronics regain some lost business. However, even though SEMATECH has declared that Mechatronics' advanced packaging tools are the best in the field, they

are still viewed as inferior to those available off-shore. Mechatronics has a $1M R&D program with SEMATECH to develop advanced robotics, and a $400K ARPA contract on CAD/CAM simulation and software development. Although Mechatronics has several R&D efforts which could have significant impact on its business, it lacks the capital needed to implement them.

Mechatronics has proposed establishing a manufacturing/user consortium for the development and manufacture of advanced robotics. Additionally, it has approached Infomatics about a joint development program.

View-all, Inc. **Japanese display manufacturer**

View-all, Inc., manufactures 95% of the world's 3-D displays for which View-all and MITI have invested $250M in their R&D. View-all is currently selling without prejudice to all US, European and Japanese companies. Its annual sales of all displays is $1B. Sales of 3-D displays at present is only $12M annually, but is expected to grow to $300M in 3 years. View-all spends $100M annually in R&D and is developing bio-interfaces and sensors that could revolutionize the industry. This new technology is 3-5 years away. View-all displays are performance limited by the electro-optic laser arrays manufactured in a subsidiary plant. View-all is interested in acquiring electro-optic array technology from Eurolaser, but has no deal pending.

Eurolaser,GmbH. **European electro-optics manufacturer**

Eurolaser, Inc., manufactures electro-optic devices. One of the technical challenges to high performance 3-D displays is a high-quality electro-optic laser array. Eurolaser has emerging technology which could revolutionize the 3-D display field, but does not have the financial ability to commercialize. View-all has been trying to purchase the technology and/or the company, but has been unable to do so to date, mainly because of political reasons. Eurolaser's display R&D is financed on a $2M ESPRIT contract and $1M from the government. Several European countries and the US have opened a dialog about cooperative efforts in microelectronics.

Rootska, Ltd. **Ukrainian Software Company**

Rootska is a company of 25 software engineers/computer scientists with a total staff of 45. Most of its products are in games and entertainment. Its claim to fame is an interactive, mentally challenging game for PC's and Nintendo-like systems called Quadratures. Rootska received $1M last year from Horioka in royalties for this game. However, the game is getting old and royalties will be significantly less this year. Most of Rootska's effort over the last 18 months has been in operating system development. A 16-man effort has been devoted to this AI software development. Rootska has technology that could revolutionize the SAMSON product by giving the

operating system a "human" appearance while still maintaining full compatibility with OSPC. It has tried to interest Infomatics and Horioka, but with little success. Several times Rootska tried to demonstrated the software, but it was severely limited by the hardware testing platform and critical software bugs. The company desperately needs financial support. It has many talented people who are severely underpaid. Many are seeking jobs in the US and Japan.

US Government Team

The US Government team has composite federal and state authorities and promotes political, social, military and economic agendas in the interests of the US citizenry.

Japanese Government Team

The Japanese Government team is to promote Japanese political, social, military and economic agendas.

European Government Team

The European Government team is to promote European political, social, military and economic agendas.

Green Team

The Green Team is the game control. They represent the rest of the world. The team represents finances, investments, consumers, raw materials suppliers, voters, the media, labor, and other governments and industries as needed. The Green Finance team operates independently and negotiates deals with the companies and governments. The Green Team will:

1) Participate in team negotiations as requested
2) Provide information and responses as needed
3) Determine probabilistic outcomes of investments and negotiations
4) Keep the game interesting and moving.

Appendix A: Technology and Policy Toolkit

Indicate the number of US dollars your team wants to spend for each option. The offer by all teams will be added for each option to get a total offering. The probability of an option being implemented increases with the total offering for that option so influencing other teams to add their offers to yours will pay. Please circle your Team .

Team	Total Assets (M$)
Infomatics	$2500
Horioka	$8300
Schmidt	$1300
Mechatronics (includes an influence factor of x10)	$180
View-all (includes an influence factor of x10)	$320
Eurolaser (includes an influence factor of x10)	$50
US/State Government (includes an influence factor of x4)	$2000
Japanese Government (includes an influence factor of x4)	$2000
European Government (includes an influence factor of x4)	$2000

Technology Options	Cost (M$) for 50% chance)	Your offer
Environment		
New environmentally benign family of chemicals are available to replace chlorofluorocarbon solvents without reducing the product yields and at a 15% cost savings compared to the old CFC process for electronics manufacture.	200	_____
Comprehensive family of environmental waste destruction processes reduces the cost of electronics manufacturing waste destruction by 75%.	160	_____
Board Assembly and Packaging		
Recently patented robotic controllers for electronics manufacturing enable precision alignment for high-density board assembly at 70% greater speed, 55% less cost per board, and 3% higher yields than currently implemented process can provide.	150	_____
New, low-surface-tension, lead-free solder has demonstrated 43% fewer soldering failures in board assembly with high-energy-density direct-chip-attach, ball-grid-array assembly technology in an environmentally benign process.	180	_____

Patented processes decrease the device failure rate of very complex PCMCIA devices and, therefore, introduce new families of functionalities for PC users at 30% less than the competitor's projected cost. 160 _____

Board Assembly breakthrough lets electronics be packaged directly on the display for a 50% reduction in size and weight. 100 _____

Packaging breakthrough lets electronics be packaged cost effectively on diamond substrates to double the computing power with good thermal management. 100 _____

Manufacturing Information and Management Systems

Industry-led cross-fertilization program with national laboratories and universities has developed a family of software applications that integrate the design-to-delivery process for complex, low-cost, mass-marketed electronics. Beta testing by a major OEM demonstrated a sustainable improvement of the learning curve (the % cost reduction for every doubling of the volume manufactured) from 77% to 65%--a world class competitive advantage. Major software manufacturer provides fully integrated and validated applications for your company. 200 _____

Intelligent-agent software demonstrated 30% more effective education and training throughout the factory, managers and employees, at 20% less cost per employee. Beta testing demonstrated a sustainable and affordable increase in worker productivity by 6% per year. 100 _____

ARPA program in manufacturing information systems provides validated computer models for accelerated engineering of electronic products without the need for extensive prototyping and testing. Design cycle time is reduced by 40%. 160 _____

Rapid Prototyping

Validated simulation and modeling tools for electronics design and development have been integrated into an intuitive synthetic environment system that reduces the design time for manufacturing cycle of complex electro-mechanical devices from 15 months to 4 months. 140 _____

Rapid Prototyping breakthrough allows prototypes of complex mechanical structures to be assembled in aluminum by quantum manufacturing techniques at build-up rates of 1 inch per hour (an engine block in 1 day). 140 _____

Photonics

New, 0.2 micron precision assembly technology for electro-optic devices demonstrated 30% improved yields (from 70% to 93%) and corresponding cost reductions in the manufacture of high-volume photonics components. 180 _____

RF and Wireless

National laboratory breakthrough increases the commercial radio frequency data rate for wireless devices between the National Information Infrastructure and unlicensed personal computer systems by a factor of 5 in an industry beta test. The advance permits wireless communications at sufficient speed to keep all mass data storage in home base computer. 180 _____

Breakthrough in spread spectrum technology eliminates the dead spots in cities and office buildings to pave the way for higher quality cellular communications everywhere and for high-data-rate wireless communications between personal assistants and central data-base servers. 200 _____

Sensors

Breakthrough in 3-D sensors and associated software increases the productivity of electromechanical assembly robots by 30% for a 15% ($45K) addition to the initial cost of the most commonly used industrial assembly robot. 160 _____

New family of highly selective and very reliable chemical sensors provides unprecedented process diagnostics and control in electronics manufacturing. Industry-national-labs teams increase throughput of validated products by 40% for a 1% increase in the initial cost of the production line. 180 _____

Software

Inference engine for artificial intelligence software allows practical adaptive learning in computer driven devices. 200 _____

Substrates

Patented, automatically controllable, continuously variable transmission enables the feeding of thin laminate substrates through high-speed electronics manufacturing devices for a 30% improvement in yield for a 3% increase in the cost of the line.	100	_____

Displays

High resolution, 3-D, direct retinal projection display becomes available at $500/unit.	200	_____
High resolution, 3-D, flat panel display (20 cm by 25 cm) becomes available for $150 each.	140	_____

Non-Technology Options	**Cost (M$) for 50% chance)**	**Your offer**
The implementation of the National Electronics Manufacturing Initiative (NEMI) Roadmap is institutionalized by an industry-led and government-partnered entity, co-funded at the rate of $300M per year (through ARPA's special procurement authority) in the form of a virtual entity with an accountable program management leadership and staff managing pre-competitive research and development performed in industry labs, national labs, and universities as the NEMI managers deem appropriate. The goal is to make the US the location of choice for electronics manufacturing.	200	_____
R&D tax credit is made permanent.	200	_____
Depreciation schedule on electronics manufacturing equipment is reduced to 2 years, in accord with their market utility time.	180	_____
A study is initiated on low-cost-capital enablers of economic growth to find ways of making US capital sources more competitive with those of other entrepreneurial countries.	200	_____
Accounting practices for doing business with government are simplified to industry standards.	200	_____
Government establishes a comprehensive and flexible policy on intellectual property rights for all government agencies.	120	_____

Industry associations and Environmental Protection Agency form partnership and improve effectiveness (performance and cost) of environmental regulation and implementation in electronics manufacturing industry, reducing the environmental compliance cost by 50%.	160	_____
A Financial Accounting Standards Board proposal devaluing stock option incentives, currently motivating employees in high-tech companies, fails to be adopted.	60	_____
Abusive shareholder suits over stock fluctuations are curbed by government action. They have been inhibiting companies' going public; high-tech companies were especially vulnerable.	80	_____
Government establishes a focal point for foreign technology monitoring and assessment.	80	_____
Government establishes interagency, joint industry-government, clean electronics initiative.	60	_____
Federal agency benchmarks and assesses global electronics manufacturing technologies.	60	_____
NEMI develops and distributes global cost of capital index on financing electronics manufacturing enterprises.	40	_____
Government establishes lifelong training policy and practice.	160	_____
State agency establishes workforce training programs; assures focus on high skill requirements needed for domestic electronics manufacturing.	120	_____
Electronics manufacturing priorities are identified and funded in SBIR-STTR.	150	_____
An infrastructure for a comprehensive (strategy through deployment) technology delivery system is established through NS&T, CIT, ESC and NEMI implementing institution.	200	_____
EPA-ARPA-industry create a forum in NII (Internet) to distribute information for electronics industry.	20	_____

Regional alliances, industry associations and consortia work with state and federal agencies to share information vital for increasing economic prosperity.	40	_____
Government decides foreign participation in government-industry co-funded projects is allowed if domestic economic activity is enhanced sufficiently to justify government investment.	160	_____
NEMI performs global economic assessment of strengths, weaknesses, opportunities, and threats for planning actions in electronics manufacturing.	60	_____
Industry-government partnership creates infrastructure for virtual enterprises to facilitate product realization.	200	_____
Glass Act is repealed to enable banks to hold equity in corporations and increase availability of low cost capital.	200	_____
Companies do not have to give government intellectual property rights for commercial applications of innovations developed with in-house funds when used on government contracts.	140	_____
Industries that are critical to defense, energy, health care, agriculture, the transportation and communication infrastructures, or the environment, are encouraged to pursue industry-led and government-partnered and co-funded (through ARPA's special procurement authority) consortia with national laboratories whose core competencies are enabling to the industry. In this manner, industry gains precompetitive technology under industry program management, the government gains closer ties with critical commercial technology for spin-on application to its public missions, and the national labs are de facto re-engineered by the industry influence without forfeiting their responsibilities to the public missions.	200	_____
SBIR grants can be used to pay for acquiring intellectual property protection by patents.	40	_____
Government subsidizes school boards to provide every child (10 to 18) a personal data assistant and free access to the Internet.	240	_____

Appendix B: Glossary of Terms

AI	Artificial Intelligence (for computer programming)
ARPA	Advanced Research Project Agency
ATP	Advanced Technology Program
CAE	Computer-Aided Engineering
CIT (CCIT)	Civilian Industrial Technology Committee, Mary Good, DOC, chair; Martha Krebs, DOE, co-chair. Subcommittees: Automotive Technologies (Mary Good chair), Electronics (Lance Glasser, ARPA), Construction and Building (Richard Wright, NIST, and Arthur Rosenfeld, DOE), Materials Technology (Lyle Schwartz, NIST), Manufacturing Infrastructure (Joseph Bordogna, NSF)
COC	Council on Competitiveness
DRAM	Dynamic Random Access Memory
EC	European Community
ESC	Electronics Subcommittee, Dr. Lance Glasser, ARPA
ESPRIT	A funding agency of the European Community similar to ARPA. All EC countries supply funds to ESPRIT, which then funds research in several areas.
GUI	Graphical User Interfaces
Keiretsu	Japanese business philosophy developed after World War 2 and based on the concept of family relationships; the keiretsu system is an interlocking network of business contacts generally closed to outsiders.
MCC	Microelectronics Computer & Technology Corporation
MEP	Manufacturing Extension Partnership, funded under NIST.
MITI	Japanese Ministry for International Trade and Industry.
MOE	Japanese Ministry of Education, Science, and Culture
NCAICM	National Center for Advanced Information Components Manufacturing, joint ARPA/DOE project; Jim Jorgensen is NCAICM Director
NEC	National Economics Council, Tom Kalil director
NEMI	National Electronics Manufacturing Initiative
NII	National Information Infrastructure
NIST	National Institute of Standards and Technology
NSTC	National Science and Technology Council (replaces FCCSET); newly formed presidential council headed by President Clinton.
NSF	National Science Foundation
OEM	Original Equipment Manufacturer
OIDA	Optoelectronics Industry Development Association, executive director David Cheney
ORD	Office of Research and Development - EPA
OS	Operating System (for computers)
OSPC	PC Operating System (Developed by Infomatics)
OSTP	Office of Science and Technology Policy, headed by John Gibbons
OTA	Office of Technology Assessment
OTP	DOC Office of Technology Policy
PCMCIA	Personal Computer Memory Chip International Association
RF	Radio Frequency
SBIR	Small Business Innovation Research
SEMATECH	Joint industry/government consortium formed in 1987
SIA	Semiconductor Industry Association, US industry formed in 1977
SRC	Semiconductor Research Corporation, SIA's first initiative, formed in 1981.
STTR	Small Business Technology Transfer
Super capacitors	Capacitors with very high energy densities, capable of being recharged in a short time (minutes); a possible high technology alternative to batteries.
TRP	ARPA Technology Reinvestment Project
VLSI	Very Large Scale Integration